A bucket for crushing and screening stone

Technical field

The present invention relates to a bucket for crushing and screening stone and similar materials, according to the preamble to the main claim.

Technological background

In the technical field in question, self-propelled vehicles equipped with buckets for collecting material such as stone or the like, inside which crushing means are provided for crushing the material collected to the desired size, are known.

Amongst others, an example of known crushing means comprises two jaws, of which one moves pivotably relative to the other and which are moved in a manner such as to compress between them, and hence to crush, the material which is introduced into the bucket. However, these crushing means lead to some disadvantages which result in poor performance and non-homogeneity in the processing of the material treated. Known buckets therefore have high power consumption and are subject to blockage due to choking with the material introduced.

Stone crushing devices are known from US 3959897, US 1954288 and DE 580475. The first document discloses an excavating bucket having a vibrating cutter head and a crusher including a pair of jaws that are moved toward one another by an eccentric oscillating shaft. The shaft oscillation is so limited as to produce just an up-and-down movement of the jaws.

Description of the invention

The main object of the present invention is to provide a bucket for crushing and screening stone and similar materials in which the crushing operation is particularly effective and efficient.

A further object is to provide a bucket in which the size of the crushed material is easily adjustable.

Another object is to produce a bucket which is subject to little or no obstruction due to blockage with the material treated.

Yet another object is to produce a bucket which can be adapted to a plurality of self-propelled vehicles and which can easily be produced in many different sizes.

A further object is to provide a bucket which permits optimal, in particular homogeneous, crushing of a plurality of different materials.

The objects proposed are achieved by the present invention by means of a bucket formed in accordance with the appended claims.

Brief description of the drawings

The characteristics and the advantages of the invention will become clearer from the detailed description of two embodiments thereof, described by way of non-limiting example with reference to the appended drawings, in which:

Figure 1 is a partially-sectioned side view of a bucket according to the invention,

Figure 2 is a partially-sectioned plan view of the bucket of Figure 1,

Figure 3 is a partially-sectioned front view of the bucket of Figure 1,

Figure 4 is a view showing a detail of a further embodiment of the bucket of Figure 1, on an enlarged scale, and

Figure 5 is a view of the detail of Figure 4 in a further operative position.

Preferred embodiments of the invention

In the drawings, a bucket formed in accordance with the present invention is generally indicated 1.

The bucket 1 is arranged for connection, in known manner, to one or more arms of a self-propelled vehicle (not shown).

The bucket 1 comprises a scoop-shaped body 2 having an inlet opening 3 for the loading of broken stone, pebbles, stones and the like and having a cross-section which is enlarged in comparison with an opposed outlet opening 4 for the discharge of the material treated, after crushing and screening.

Stone-crushing means are mounted in the scoop-shaped body 2 and comprise a movable crushing jaw 5 and an opposed fixed crushing jaw 6 fixed firmly to the body 2. Both the movable jaw and the fixed jaw 5, 6 include respective frames 5a, 6a on which plates 5b, 6b are fitted removably; the plates 5b, 6b are provided with longitudinal grooves, all indicated 20, extending parallel to the direction of flow of the stone introduced and suitable for facilitating the crushing thereof. The grooves 20 define a plurality of ribs 20a and recesses 20b, alternating in succession in a manner such that a rib 20a of the movable jaw 5 corresponds to a recess 20b of the fixed jaw 6, so that, during the movement of the first jaw 5, the crushing of the material is homogeneous. Moreover, since the ribs 20a of one jaw can penetrate the recesses 20b of the other jaw, the crushing can be particularly fine.

The plates 5b, 6b are reinforced and restrained, by respective undercuts, by means of retaining strips 40.

Respective first and second opposite ends 7, 8 are defined in each of the jaws 5, 6, the first ends 7 of the fixed and movable jaws 6, 5 being positioned in the region of the inlet opening 3, and the second ends 8 being positioned in the region of the outlet 4. The distance between the first ends 7 of the jaws 5 and 6 determines the maximum size of the stone which can be loaded into the bucket and is greater than the distance

between the second ends 8 which, on the other hand, is correlated with the desired maximum size of the crushed stone at the outlet. Both the distance between the first ends 7 and the distance between the second ends 8 are adjustable, as explained in detail below.

The bucket 1 also comprises means for moving the movable jaw 5, including drive means, for example, a hydraulic motor 9, which is housed inside the scoop-shaped body 2 and drives a drive shaft 10 on which a first pulley 11 is keyed. The rotary movement of the first pulley 11 is transmitted, by means of a belt transmission 12, to a second pulley 13, keyed to a shaft 14.

A first eccentric 15 and a second eccentric 16 are arranged on the shaft 14, in phase with one another, and each is coupled with a respective first or second bearing 17, 18. A hollow sleeve 19 is fitted on the two bearings 17, 18 so as to be freely rotatable relative thereto and the movable jaw 5 is fixed, in the region of its first end 7, to the outer surface 19a of the sleeve 19, so as to be moved by the shaft 14 together with the sleeve 19.

The drive means 9 are also arranged, when necessary, to drive vibrator means 50 acting on the fixed jaw 6 and disposed in the region of the inlet opening 3, for bringing about pulsed vibrations of the jaw 6 so as to release any material which has become stuck.

The bucket 1 also comprises means 22 for adjusting the movement of the movable jaw 5 and the size of the cross-section of the outlet 4. The adjustment means 22 comprise a strut 23 interposed and restrained between respective first and second channels 25, 33, of which one is mounted on the frame 5a of the movable jaw 5 and the other on a support 41 fixed firmly to the scoop-shaped body 2. The ends 24a, 24b of the strut 23 which are housed in the channels 25, 33 are rounded to facilitate their pivoting about the respective contact lines.

A set of removable spacers 34 is interposed between the support 41 and the corresponding second channel 33 for the adjustment of the size of the cross-section of the outlet 4. The second channel 33 is welded to the end spacer.

In a first embodiment of the invention of Figure 1, the channel 33 is welded centrally to the end spacer whereas, in a further embodiment shown in Figures 4 and 5, the channel 33' is welded in the region of an edge of the spacer. By varying the position of the second channel 33, 33' relative to the end spacer, the angle between the

movable jaw 5 and the strut 23 can in turn be adjusted in order to vary in the manner described below. By virtue of the characteristics just described, the strut 23 can be positioned in three different operative positions: a first, central operative position, in which the second channel 33 is spaced equally from two opposed walls 35a, 35b of the support 41, and which can be achieved with the use of the channel 33 welded as shown in Figure 1, a second operative position in which the channel 33' is close to the first wall 35a, and a third position in which it is close to the second wall 35b, which can be achieved, from the second operative position, by removing the spacer and channel 33' and reinserting them having rotated them through 180° (thus changing from the operative position of Figure 4 to that of Figure 5). According to the operative position selected, the angle formed between the strut 23 and the movable jaw 5, in particular, the angle between an axis Y joining the centre of rotation of the pulley 13 and the point P at which the strut 23 is supported in the first channel 25, and an axis Z of the strut 23 extending through the support point P, is varied. This angle is 45°, 40° and 50° in the three operative positions listed above, respectively.

The bucket 1 also comprises resilient means, in particular, a spring 30, a first end of which is connected to the scoop-shaped body 2, and a second, opposite end of which is connected to the second end 8 of the movable jaw 5, so as to keep the strut 23 restrained between the first and second channels 25, 33 (or 33') during the movement of the jaw 5. A mechanism 51 for adjusting the load exerted by the spring 30, such as a screw coupling system, is also provided on the scoop-shaped body 2.

The bucket 1 according to the invention operates as follows.

The stone or other material to be crushed is collected by the bucket 1 in conventional manner. In order to send the material collected towards the jaws 5, 6, the bucket 1 is pivoted through 90° from the position in which it is shown in Figure 1, that is, the outlet 4 is arranged at a height below the inlet opening 3 so that the material is urged towards the jaws 5, 6 simply by the effect of gravity.

The flow of material is facilitated with the use of the vibrator means 50, even if the inlet opening 3 is positioned at the same height as the outlet 4.

The movable jaw 5 is moved by operation of the hydraulic motor 9 which transfers the movement from the first pulley 11 to the second pulley 13 and consequently to the shaft 14. Owing to the effect of the two eccentrics 15, 16, the sleeve 19, which is freely rotatable on the bearings 17, 18, can perform a rotational/translational

movement relative to the axis of the shaft 14; in particular, the first end 7 of the movable jaw 5, which is fixed to the sleeve 19, is moved from a first position, in which the inlet opening 3 has a maximum cross-section, to a second, opposite position which differs from the first by a rotation of the eccentrics 15, 16 through 180°, and in which the inlet opening 3 has a minimum cross-section. The first end 7 of the movable jaw 5 adopts all of the intermediate positions between the above-defined first and second positions, during its rotational/translational movement.

Since the movable jaw 5 is a rigid body, movements of the first end 7 result in corresponding movements of the second end 8 which, however, is restrained by the spring 30 and by the strut 23. The movements of the end 8 are permitted by the pivoting of the ends 24a, 24b of the strut 23 within the first and second channels 25, 33 (33'), respectively, so that the inclination of the strut 23 relative to the jaw 5 is varied continuously during the movement of the jaw 5. The resulting movement comprises a component substantially perpendicular to the jaw 5 and a component parallel thereto, along the direction of flow of the stone, in a manner similar to a "chewing" motion, promoting crushing of the stone and its movement towards the outlet 4.

The maximum size of the cross-section of the outlet 4 can also be adjusted by increasing or reducing the number of spacers 34 located inside the support 41, thus varying the maximum size of the crushed stone.

The movement of the jaw 5 can also be modified, thus changing the characteristics of the crushing due to the relative movement of the jaws 5, 6, by varying the inclination between the strut 23 and the jaw 5 at rest, as described above. With the use of the configuration shown in Figure 4, in which the inclination between the strut 23 and the jaw 5 is least, the movement of the end 8 of the movable jaw 5 comprises a considerable translational component in the direction of the flow of the material, thus facilitating the movement of the material towards the outlet 4. This position is therefore particularly suitable when materials which form blockages easily, for example, moist or fine-grained materials, are being processed. The positioning shown in Figure 5, which can be achieved by rotating the channel 33' welded to the spacer through 180°, on the other hand, is particularly suitable when a considerable crushing power is required.

The invention thus achieves the objects proposed, also affording numerous advantages over the prior art referred to.

A first advantage afforded by the bucket according to the invention is that it is possible to optimize the crushing of the stone by virtue of the plurality of adjustments permitted, by adjusting the relative movement of the jaws in dependence on the material.

Moreover, the size of the crushed stone can easily be adjusted.

One of the main advantages is that the power consumption of the bucket according to the invention is less than that of conventional buckets, by virtue of the greater efficiency achieved by the process, which also leads to a reduction in processing time and to a reduction in noise emitted.

Moreover, the crushing performed by means of the above-described bucket is particularly uniform.

One of the main advantages is that, by virtue of the type of movement of the jaw and of the provision of vibrator means, blockages of material and consequent stoppages of the processing are minimized.